Claims

1. An arrangement for controlling a combustion engine whereby the combustion engine (1) comprises a combustion chamber (3), a movable piston (4) adapted to compressing a fuel mixture in the combustion chamber (3) so that self-ignition of the fuel mixture takes place, a crankshaft (5) driven by movements of the piston (4), an inlet valve (8) to the combustion chamber (3) and an exhaust valve (11) from the combustion chamber (3), which arrangement comprises a control unit (19) adapted to controlling the self-ignition of the fuel mixture to an optimum crankshaft angle (cad_{iopt}) within a load range (L_{tot}), characterised in that said load range (L_{tot}) can be divided into at least two subranges (L_{II}, L_{III}) and the control unit (19) is adapted to controlling the self-ignition of the fuel mixture towards an optimum crankshaft angle (cad_{iopt}) within one of said subranges (L_{II}) by means of a strategy (II) which entails the effective compression ratio (c) in the cylinder (2) being varied within a range bounded downwards by a lowest acceptable compression ratio (c_{min}), and within a second subrange (L_{III}) by means of a strategy (III) which entails cooled exhaust gases (ceg) being led to the combustion chamber (3) in a quantity such that it becomes possible also within the second subrange (L_{III}) to control the self-ignition of the fuel mixture towards an optimum crankshaft angle (cad_{iopt}) by variation of the effective compression ratio (c) within the range bounded downwards by the lowest acceptable compression ratio (c_{min}).

2. An arrangement according to claim 1, characterised in that the control unit (19) is adapted to regulating the effective compression ratio (c) in the cylinder (2) by initiating variable inlet valve closure (ivc).

3. An arrangement according to any one of the foregoing claims, characterised in that the arrangement comprises a hydraulic control system (18a) for controlling the variable inlet valve closure (ivc).

4. An arrangement according to any one of the foregoing claims, characterised in that the arrangement comprises a return line (13) extending from an exhaust line (12) of the combustion engine to an inlet line (7) for air supply to the combustion chamber (3).

5. An arrangement according to claim 4, characterised in that said return line (13) comprises a valve (14) for controlling the supply of exhaust gases to the inlet line (7).

6. An arrangement according to claim 3 or 5, characterised in that the return line (13) comprises a cooler (15) for cooling the exhaust gases before they reach the inlet line (7).

7. An arrangement according to any one of the foregoing claims, characterised in that the arrangement comprises a first sensor (16) for detecting a parameter (p) which indicates the start of a combustion process in the combustion chamber (3), and a second sensor (17) for estimating the crankshaft angle (cad) of the combustion engine (1), and the control unit (19) is adapted to determining the crankshaft angle (cad_i) for the start of the combustion process.

8. An arrangement according to claim 7, characterised in that said first sensor is a pressure sensor (16) which detects the pressure (p) in the combustion chamber (3).

9. An arrangement according to claim 7 or 8, characterised in that the control unit (19) is adapted to comparing the estimated crankshaft angle (cad_i) at the self-ignition of the combustion process with stored information concerning the optimum crankshaft angle (cad_{iopt}) for self-ignition of the combustion process and to using that information for controlling the self-ignition of the following combustion process.

10. An arrangement according to any one of the foregoing claims, characterised in that the arrangement comprises an injection nozzle (10) for fuel injection into the combustion chamber (3) when the inlet valve (8) is open.

11. A method for controlling a combustion engine whereby the combustion engine (1) comprises a combustion chamber (3), a movable piston (4) adapted to compressing a fuel mixture in the combustion chamber (3) so that self-ignition of the fuel mixture takes place, a crankshaft (5) driven by movements of the piston (4), an inlet valve (8) to the combustion chamber (3) and an exhaust valve (11) from the combustion chamber (3), which method comprises the step of controlling the self-ignition of the fuel mixture towards an optimum crankshaft angle (cad_{iopt}) within a load range (L_{tot}), characterised in that said load range (L_{tot}) can be divided into at least two subranges (L_{II}, L_{III}) and the method comprises the steps of controlling the self-ignition of the fuel mixture towards an optimum crankshaft angle (cad_{iopt}) within one of said subranges (L_{II}) by means of a strategy (II) which entails the effective compression ratio (c) in the

cylinder (2) being varied within a range bounded downwards by a lowest acceptable compression ratio (c_{min}), and within the second subrange (L_{III}) by means of a strategy (III) which entails cooled exhaust gases (ceg) being led to the combustion chamber (3) in a quantity such that it becomes possible also within the second subrange (L_{III}) to control the self-ignition of the fuel mixture towards an optimum crankshaft angle (cad_{iopt}) by variation of the effective compression ratio (c) within the range bounded downwards by the lowest acceptable compression ratio (c_{min}).

12. A method according to claim 11, <u>characterised</u> by the step of regulating the effective compression ratio in the cylinder (2) by initiating variable inlet valve closure (ivc).

13. A method according to claim 12, <u>characterised</u> by the step of controlling the variable inlet valve closure (ivc) by means of a hydraulic control system (18a).

14. A method according to any one of claims 11-13 above, <u>characterised</u> by the step of leading said cooled exhaust gases (ceg) to the combustion chamber (3) via a return line (13) extending from an exhaust line (12) of the combustion engine to an inlet line (7) for air supply to the combustion chamber (3).

15. A method according to claim 14, <u>characterised</u> by the step of controlling the supply of exhaust gases to the inlet line (7) by means of a valve (14).

16. A method according to claim 14 or 15, <u>characterised</u> by the step of cooling the exhaust gases before they reach the inlet line (7) by means of a cooler (15).

17. A method according to any one of claims 11-16 above, <u>characterised</u> by the steps of determining the crankshaft angle (cad_i) at the start of the combustion process by detecting a parameter (p) which is related to the combustion process in the combustion chamber (3), and of detecting the crankshaft angle (cad) of the combustion engine (1).

18. A method according to claim 17, <u>characterised</u> in that said parameter detected is the pressure (p) in the combustion chamber (3).

19. A method according to claim 17 or 18, <u>characterised</u> by the steps of comparing the estimated crankshaft angle (cad_i) at the start of the combustion process with stored

information concerning the optimum crankshaft angle (cad_{iopt}) for the start of the combustion process, and of using that information for controlling the self-ignition of the following combustion process.

20. A method according to any one of claims 11-19 above, characterised by the step of injecting fuel into the combustion chamber (3) via an injection nozzle (10) when the inlet valve (8) is open.